



299-E33-16 (A6855)

Log Data Report

Borehole Information:

Borehole: 299-E33-16 (A6855)		Site: 216-B-8 Crib			
Coordinates (WA State Plane)		GWL (ft)¹: 240.64	GWL Date: 12/27/01		
North 137465	East 573792	Drill Date Jan. 1953	TOC² Elevation 632.53 ft	Total Depth (ft) 258.44	Type Cable tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Steel Welded	2.5	8.625	8.0	0.3125	2.5	247

Borehole Notes:

Groundwater level and total depth were measured when the pump was pulled on 12/27/01. The well was swabbed on 12/27/01, and no contamination was detected.

This well is located on the side of a built-up area (berm), and it appears the original casing has been extended (the as-built drawing reports a stickup of 0.5 ft). The length of the extension cannot be measured. The logging engineer measured the stick up using an engineer's tape and caliper. Casing bottom is reported from information provided on the as-built drawing. The Duratek well services crew reported the total depth when the pump was pulled on 12/27/01. Open hole in basalt from 247 to 258.44 ft.

Zero reference = Top of Casing (TOC)

Logging Equipment Information:

Logging System:	Gamma 1D	Type:	SGLS (35%)
Calibration Date:	07/01	Calibration Reference:	GJO-2001-243-TAR
		Logging Procedure:	MAC-HGLP 1.6.5, Rev 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	5
Date	01/08/02	01/09/02	01/10/02	01/10/02	
Logging Engineer	Kos	Kos	Kos	Kos	
Start Depth (ft)	2.5	170.0	168.0	230.0	
Finish Depth (ft)	67.5	65.5	255.0	255.5	
Count Time (sec)	100	100	100	100	
Live/Real	R	R	R	R	
Shield (Y/N)	N/A ³	N/A	N/A	N/A	
MSA Interval (ft)	0.5	0.5	0.5	0.5	
ft/min	N/A	N/A	N/A	N/A	
Pre-Verification	A0070CAB	A0071CAB	A0072CAB	A0072CAB	

Log Run	1	2	3	4	5
Start File	A0070000	A0071000	A0072000/ A0072226	A0072175	
Finish File	A0070130	A0071209	A0072174/ A0072232	A0072225	
Post-Verification	A0070CAA	A0071CAA	A0072CAA	A0072CAA	
Depth Return Error (in)	-1.75	-0.875	-1.75	NA	
Comments			TD logged 258.4 ft	Repeat survey	

Logging Operation Notes:

Low activity Cs-137 was observed during acquisition of the pre-survey verification data. Zero reference is the top of casing.

Logging was performed with a centralizer on the sonde. The logging tool was sleeved for the survey completed within groundwater (1/10/02). Two-foot overlaps were logged between the starting depths of each survey (no overlap for the repeat survey). No fine-gain adjustments were made during the logging runs. Cobalt-60 was detected in the previous (9/97) spectral gamma log beneath the groundwater level.

Analysis Notes:

Analyst:	Sobczyk	Date:	01/22/02	Reference:	MAC-VZCP 1.7.9 Rev. 2
-----------------	---------	--------------	----------	-------------------	-----------------------

Pre-run and post-run verification spectra were collected at the beginning and end of each day. The recorded peak counts per second (cps) for the 609-keV peak, 1461-keV peak, and 2615-keV peak were consistently lower each day in the post-run verification as compared to the pre-run verification. This change varied from 6 to 9 percent. The cause of this discrepancy is being investigated. Evaluation of the spectra indicates that the detector is functioning normally, and the log data are provisionally accepted, subject to further review and analysis. The post-run verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR.

Individual spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated in EXCEL (source file: g1dcalc4.xls), using parameters determined from analysis of calibration data collected in July 2001. The casing configuration was assumed to be one string of 8-in. casing with a thickness of .3125 in. to a log depth of 247 ft (Ledgerwood 1992). The casing thickness of 0.3125 is consistent with the logging engineer's measurements. A casing correction was not applied to the log data below 247 ft. A water correction was applied below 240 ft. Zero reference is the top of the casing.

Dead time was greater than 40 percent in the intervals from 27 to 36 ft and 48 to 50 ft, and data from this region are considered unreliable. Dead time corrections were required where the tool was not saturated. At dead time greater than 40 percent, peak spreading and pulse pile-up effects may result in underestimation of activities. This effect is not entirely corrected by the dead time correction, and the extent of error increases with increasing dead time.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (⁴⁰K, ²³⁸U, and ²³²Th), and man-made radionuclides. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. In addition, comparison log plots of man-made radionuclides are provided that compares data collected with Waste Management Federal Systems Northwest's Radionuclide Logging System (RLS) with SGLS data. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide.

Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation.

Results and Interpretations:

^{137}Cs and ^{60}Co , which are man-made radionuclides, were detected in significant amounts in this borehole. ^{137}Cs contamination was detected near the ground surface (log depth 2.5 through 6.5 ft) with activities ranging from 0.3 to 19.1 pCi/g. ^{137}Cs occurred between about 22 and 177 ft. In this interval, activities exceeded 1,000 pCi/g between 27 to 36 ft and 48 to 50 ft. ^{137}Cs was detected at low levels between 190 and 210 ft and at trace concentrations at 232 ft and at the bottom of the borehole. ^{60}Co was detected at concentrations less than 1.0 pCi/g in the interval between 217 to 223 ft. ^{60}Co was detected below the last reported groundwater level (240.6 ft) in the interval between 237 and 253.5 ft. The maximum concentration detected was 8 pCi/g at 252.5 ft. In May 2000, ^{60}Co was detected in the groundwater at a concentration of 10.9 pCi/liter (PNNL 2001).

Above the zone of intense gamma-ray activity, apparent ^{40}K activities are about 12 pCi/g. Below this zone of intense gamma-ray activity, apparent ^{40}K activities are about 17 pCi/g. The relatively high concentrations of ^{137}Cs below about 27 ft may correspond with the increase in ^{40}K activities and the transition from the coarse-grained sediments of the Hanford H1 to the finer grained sediments of the Hanford H2. Similarly, the decrease in ^{40}K activities at 212 ft from 15 to 12 pCi/g may represent change from the H2 to the coarse-grained sediments of the Hanford H3. The top of the basalt is picked at 247 ft based on the apparent decrease in KUT.

Comparison log plots of data collected in 1997 with the Waste Management Federal Systems Northwest's RLS and in 2002 with the SGLS are included. The RLS concentration data (^{137}Cs and ^{60}Co) were decayed to the date of the SGLS logging event in January 2002. The comparison shows good agreement between the logging systems for both ^{137}Cs and ^{60}Co . There were no apparent changes in the contaminant profile for the entire length of the borehole except for the interval from 223 to 238 ft (shaded gray on expanded plot). In this interval, the RLS detected trace amounts of ^{137}Cs (0.2 to 0.7 pCi/g) while the SGLS only found 0.3 pCi/g of ^{137}Cs at 232 ft. In addition, the SGLS repeat log run from 230 to 255 ft did not detect ^{137}Cs . The MDL for the SGLS in the interval from 223 to 238 ft is about 0.3 pCi/g. At all other depths, there was good agreement between the two systems where concentrations of ^{137}Cs were less than 1.0 pCi/g and at higher concentrations. The source of the discrepancy in ^{137}Cs values from 233 to 238 ft is not known.

Because of the high activities encountered by the SGLS, the intervals between 26.0 to 38.0 ft and 47.0 to 51 ft should be logged with the High Rate Logging System.

References:

Ledgerwood, R.K., 1992. *Summaries of Well Construction Data and Field Observations for Existing 200 East Aggregate Area Operable Unit Resource Protection Wells*, Draft WHC-SD-ER-T12EAA, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Pacific Northwest National Laboratory (PNNL), 2001. *Hanford Site Groundwater Monitoring for Fiscal Year 2001*, PNNL-13404, Pacific Northwest National Laboratory, Richland, Washington.

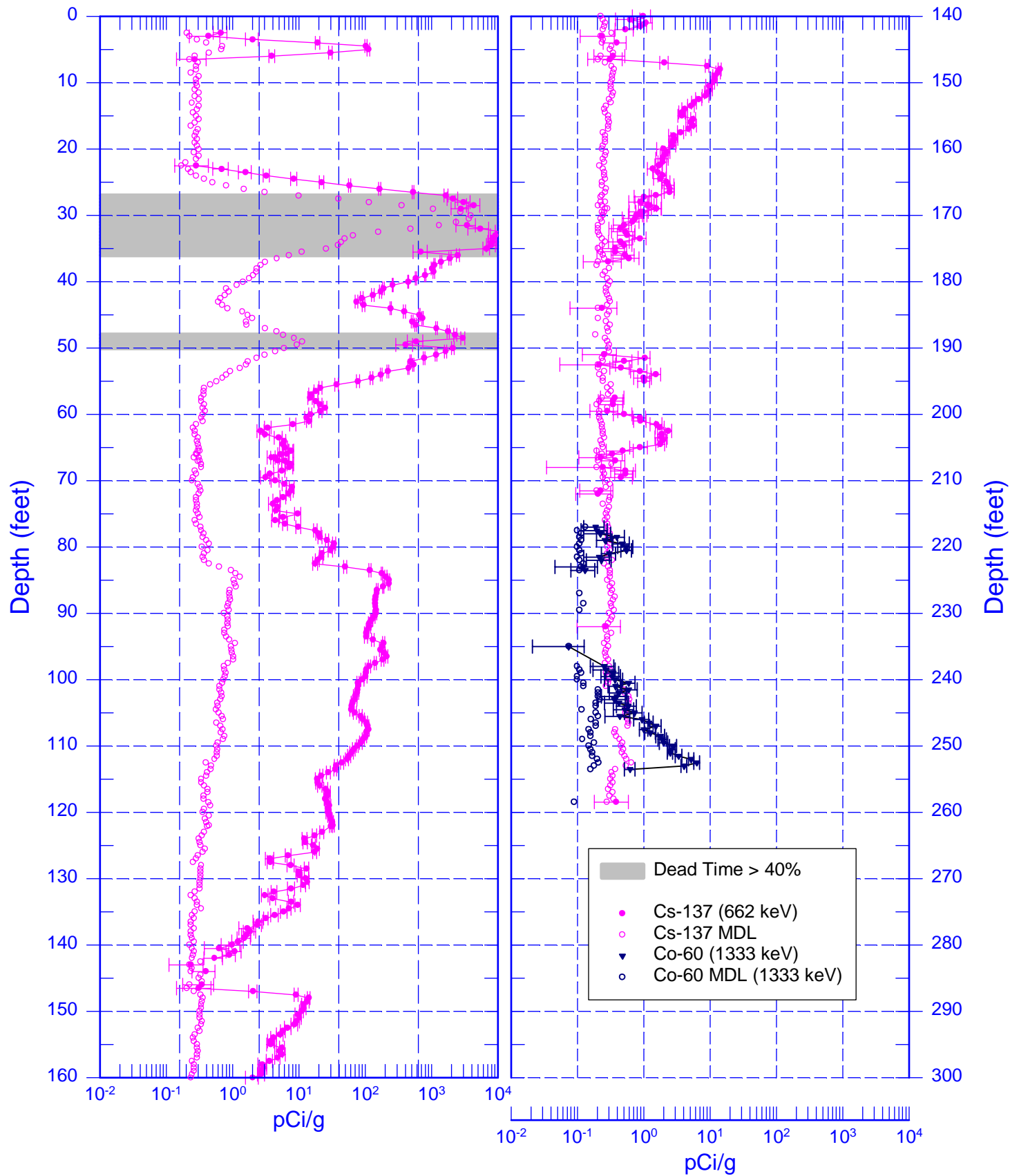
¹ GWL – groundwater level

² TOC – top of casing

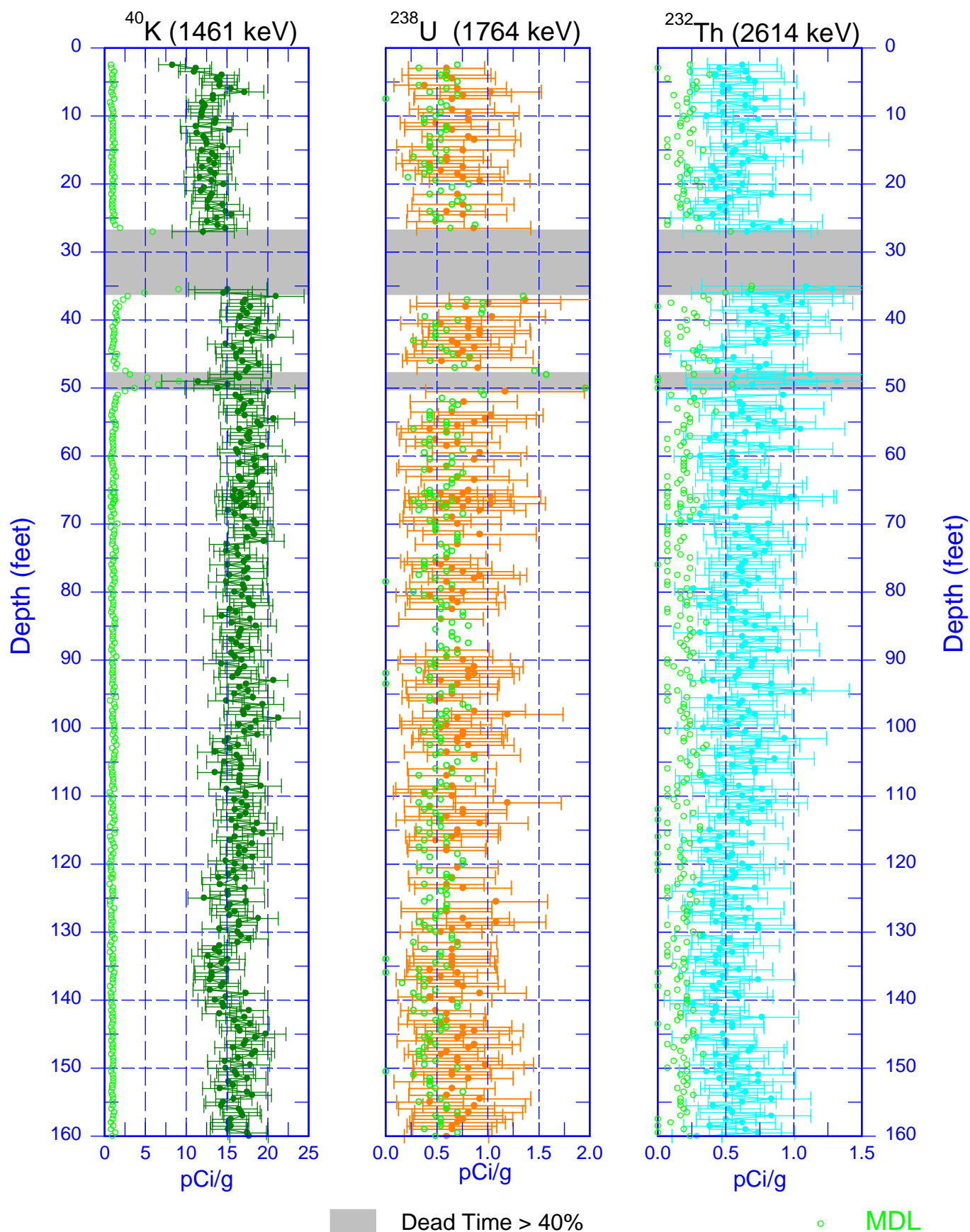
³ N/A – not applicable

299-E33-16 (A6855)

Man-Made Radionuclides

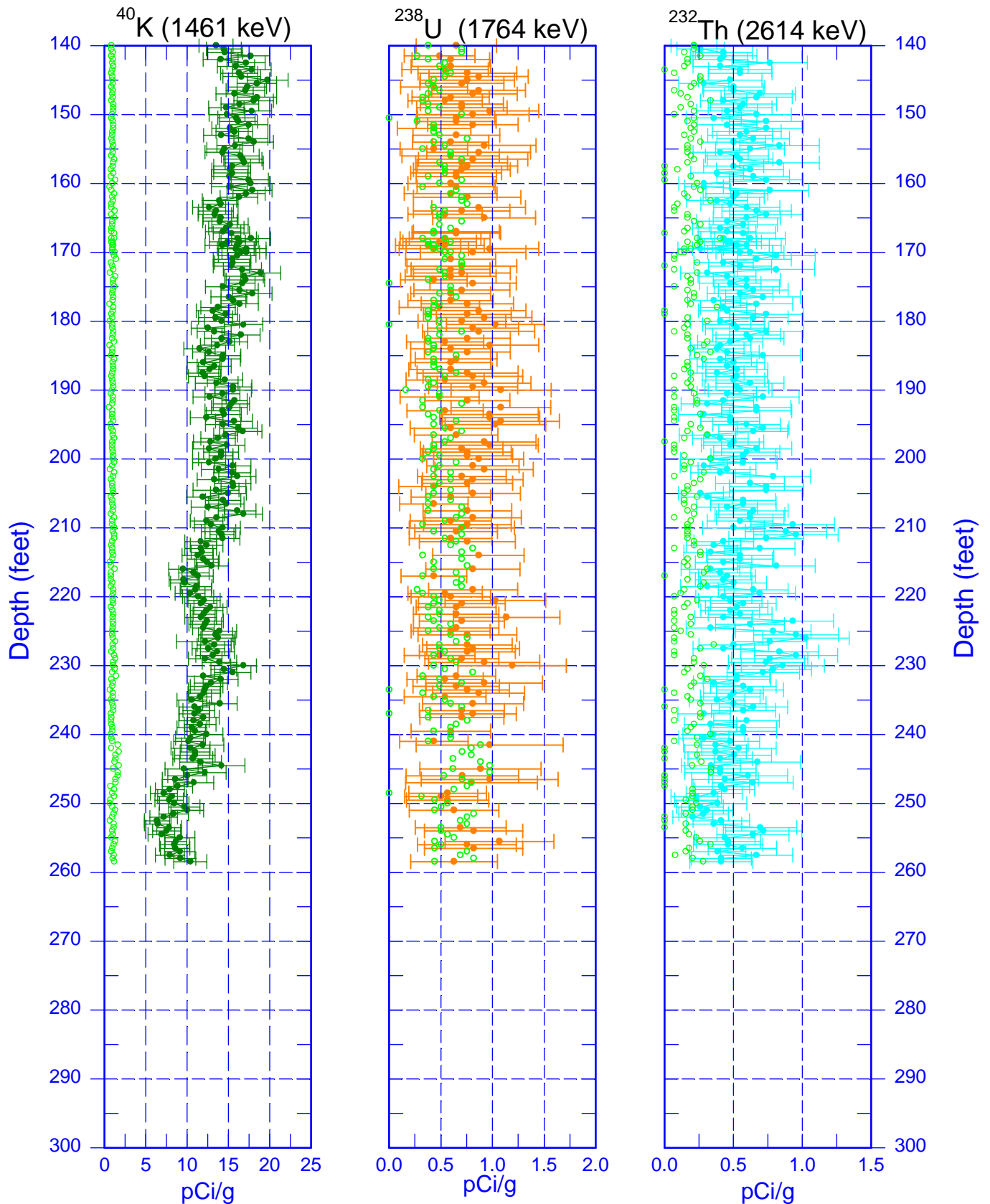


299-E33-16 (A6855) Natural Gamma Logs

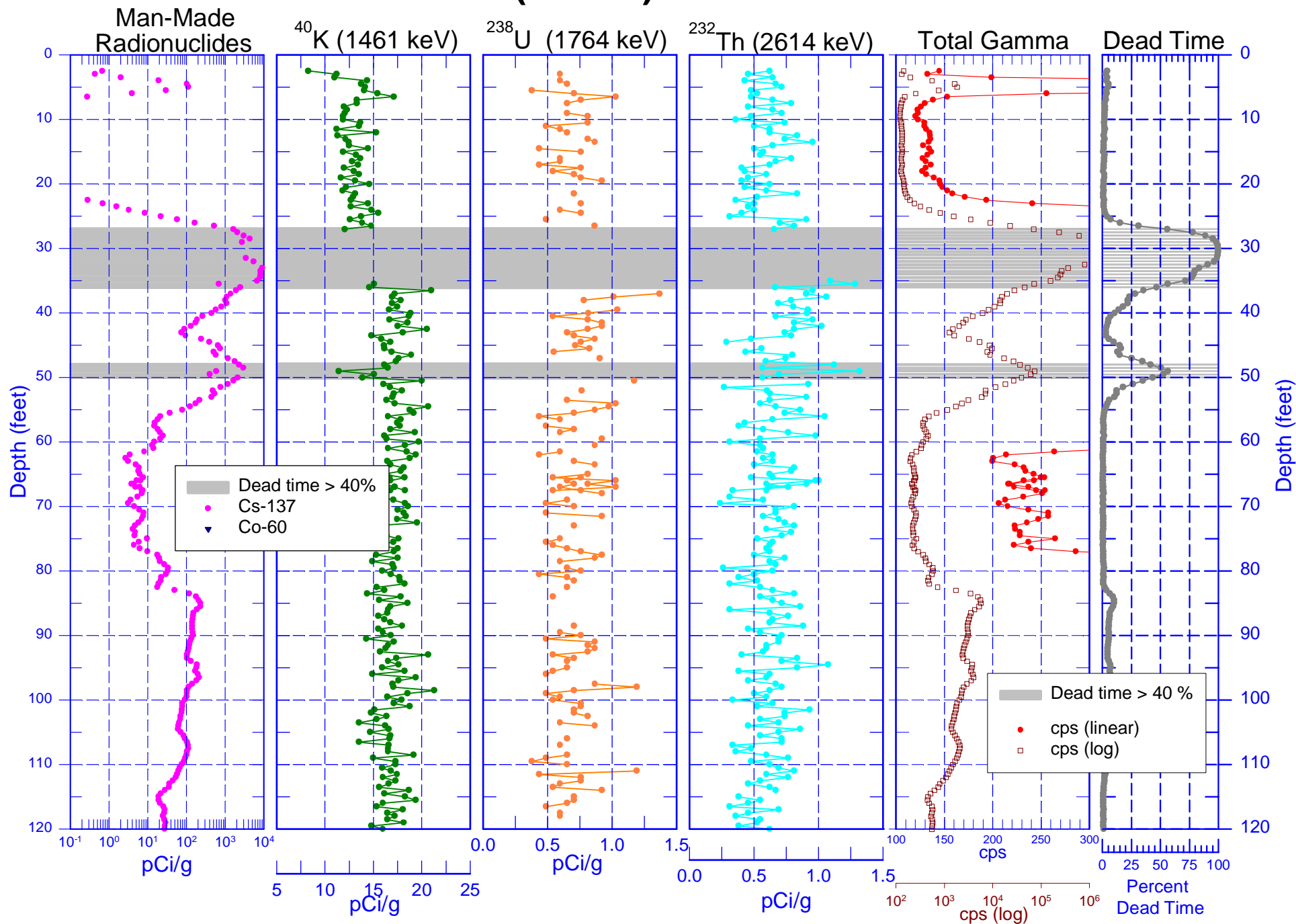


299-E33-16 (A6855)

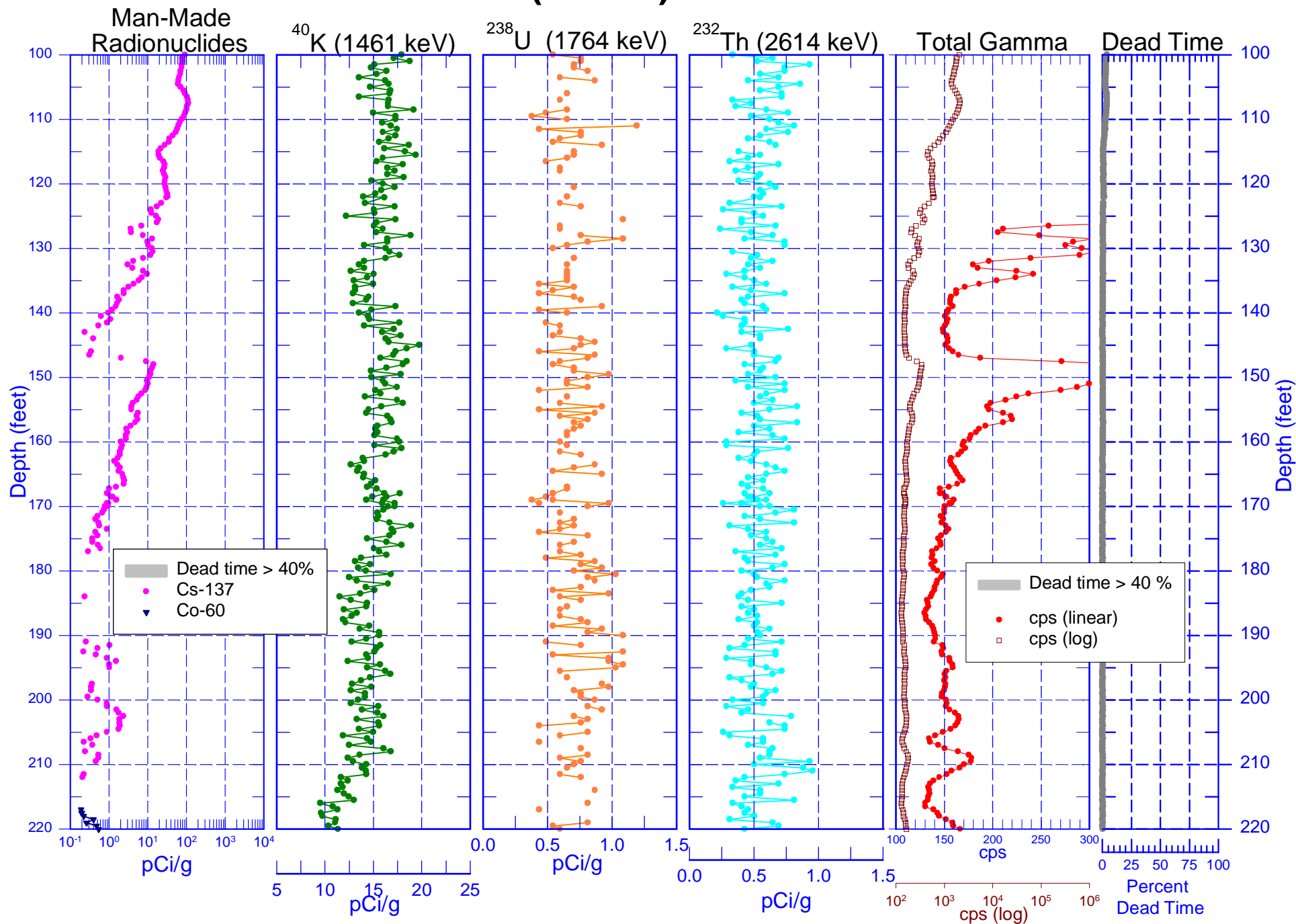
Natural Gamma Logs



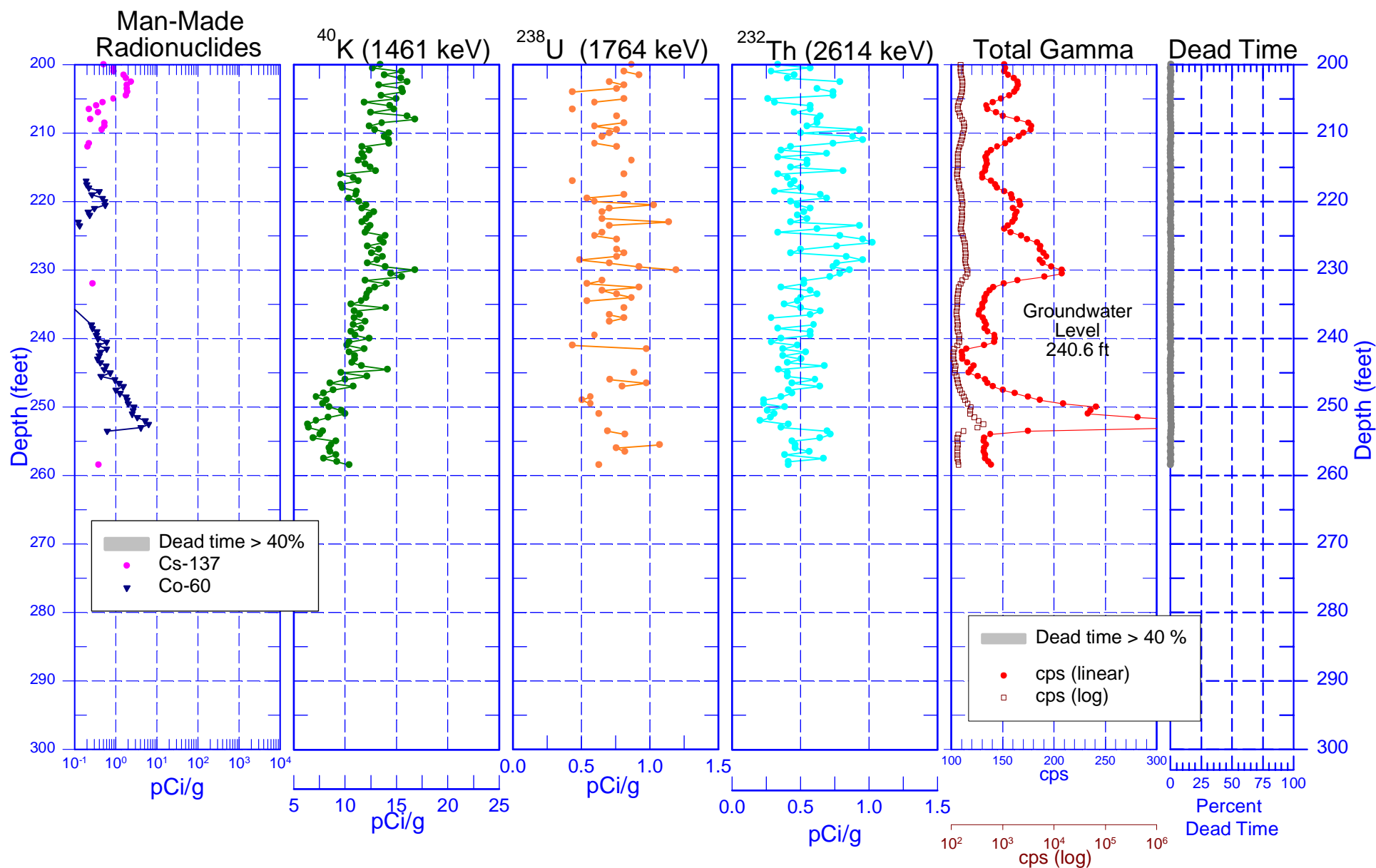
299-E33-16 (A6855) Combination Plot



299-E33-16 (A6855) Combination Plot

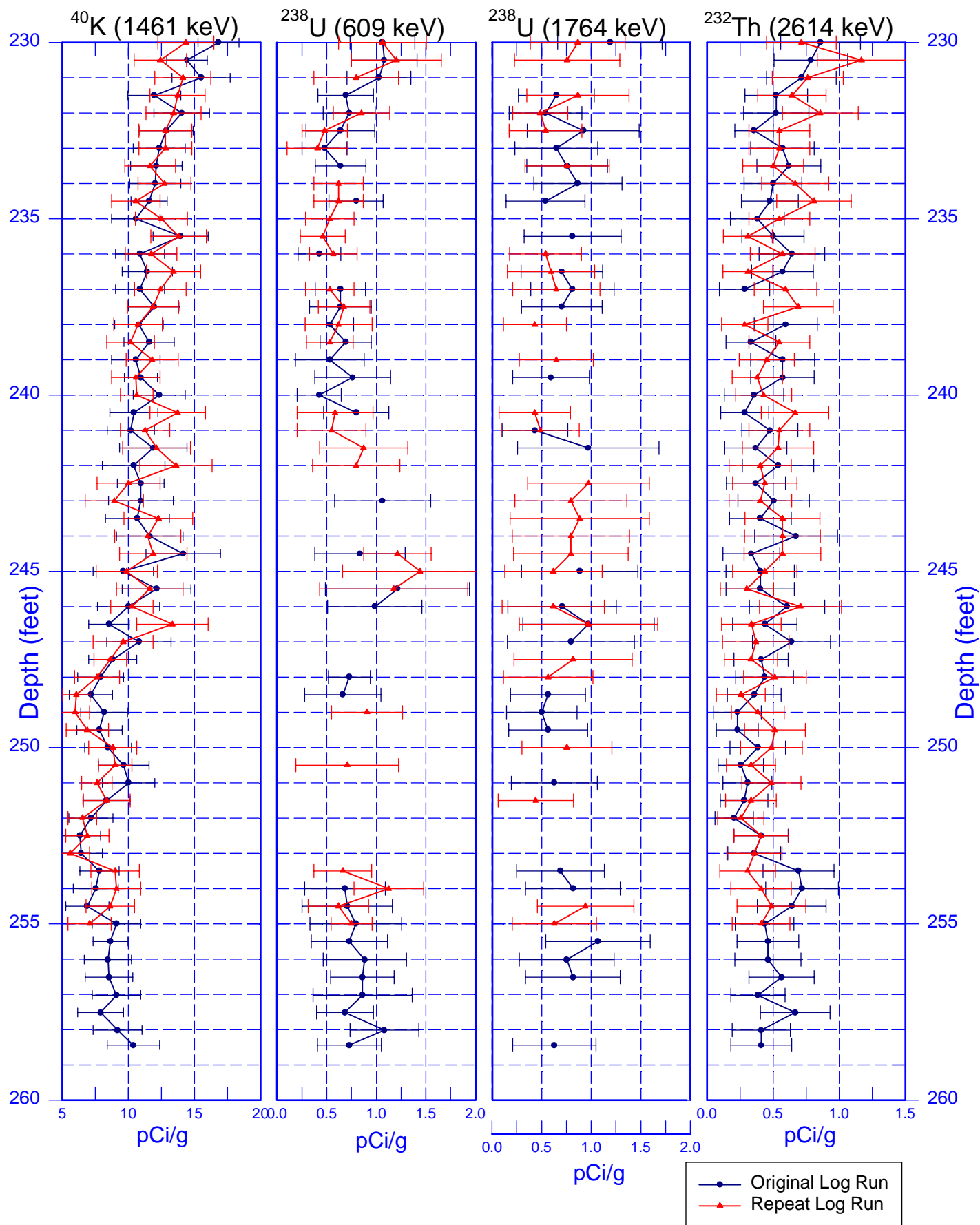


299-E33-16 (A6855) Combination Plot



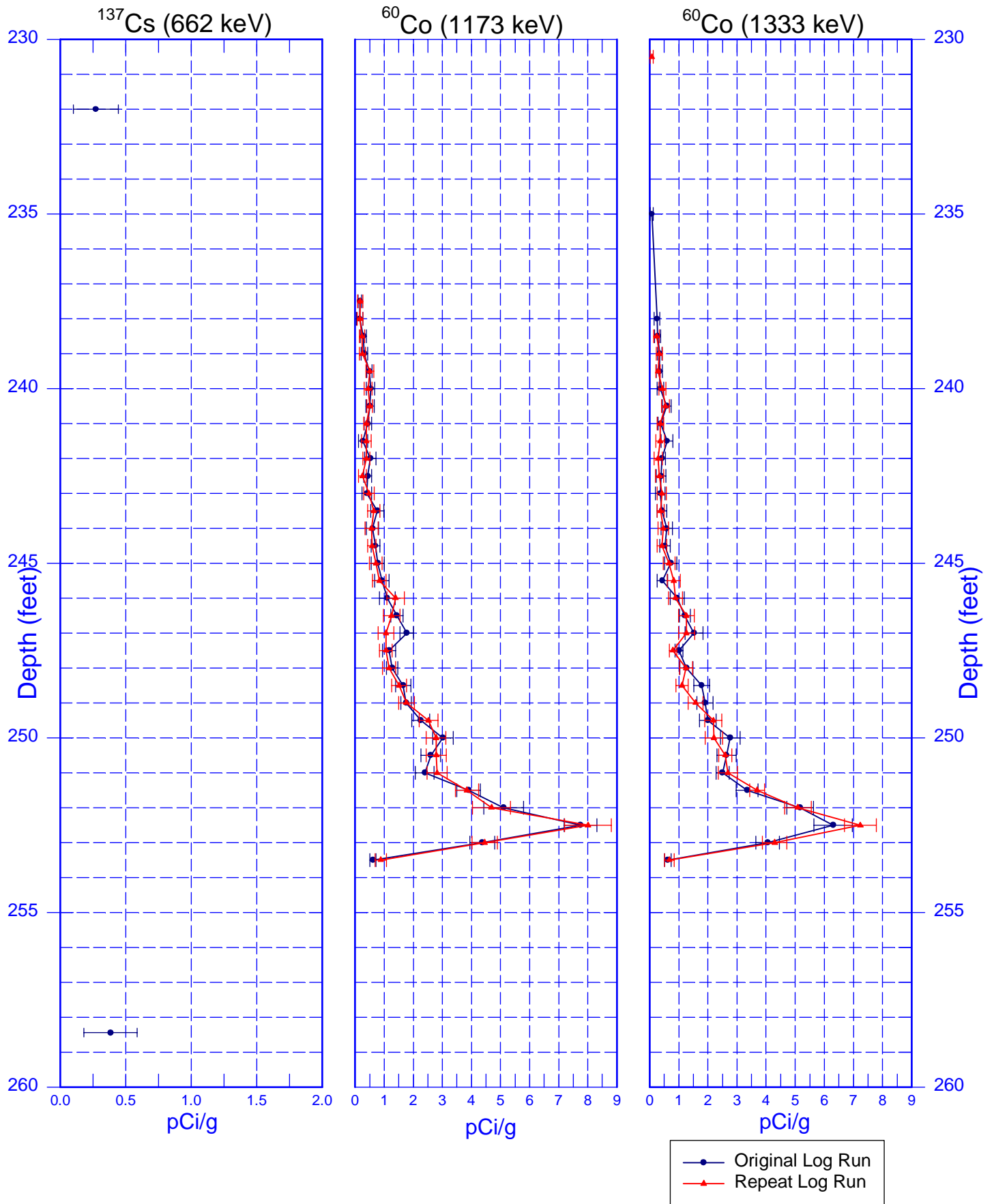
299-E33-16 (A6855)

Rerun of Natural Gamma Logs



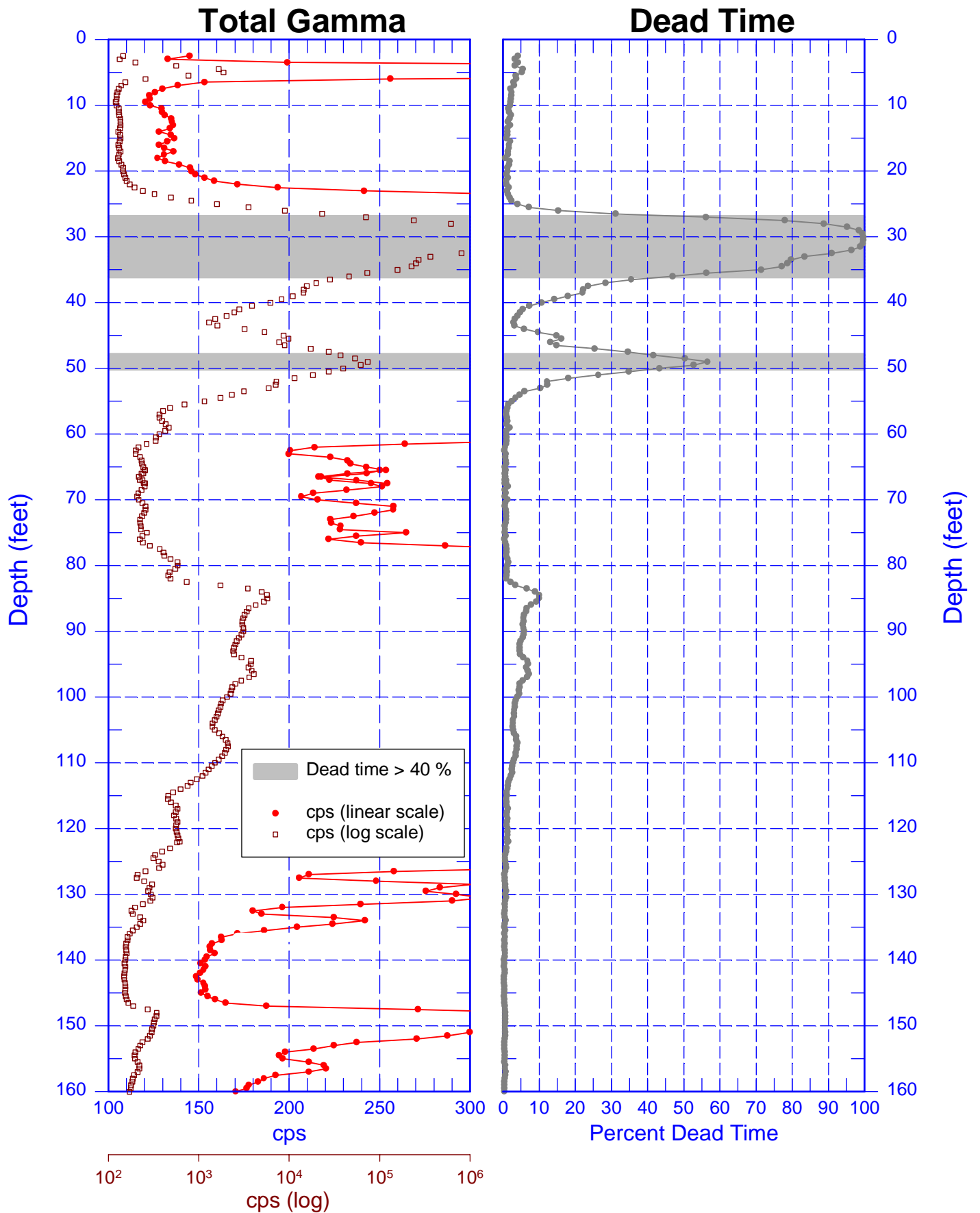
299-E33-16 (A6855)

Rerun of Man-Made Radionuclides (230-255 ft)



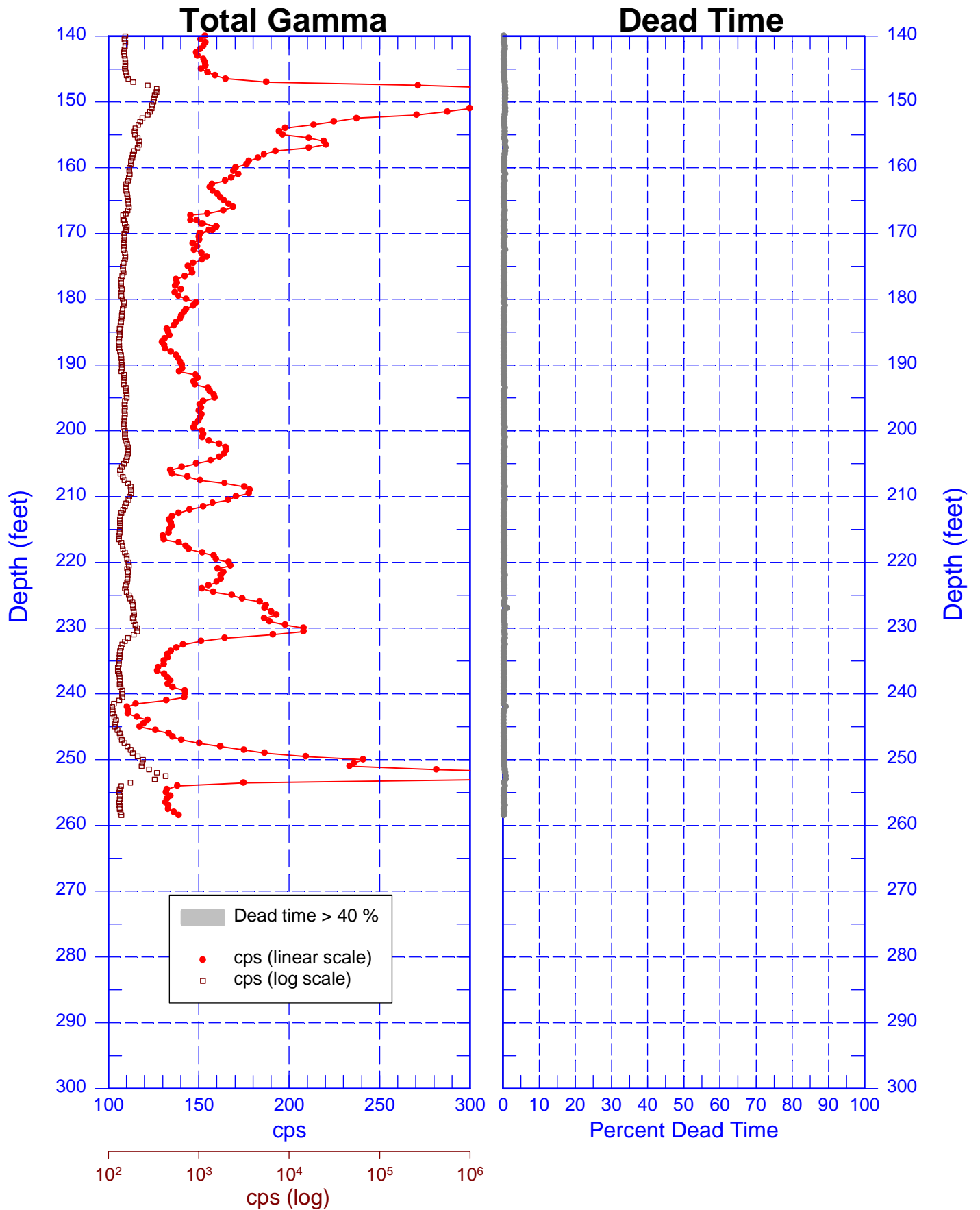
299-E33-16 (A6855)

Total Gamma & Dead Time



299-E33-16 (A6855)

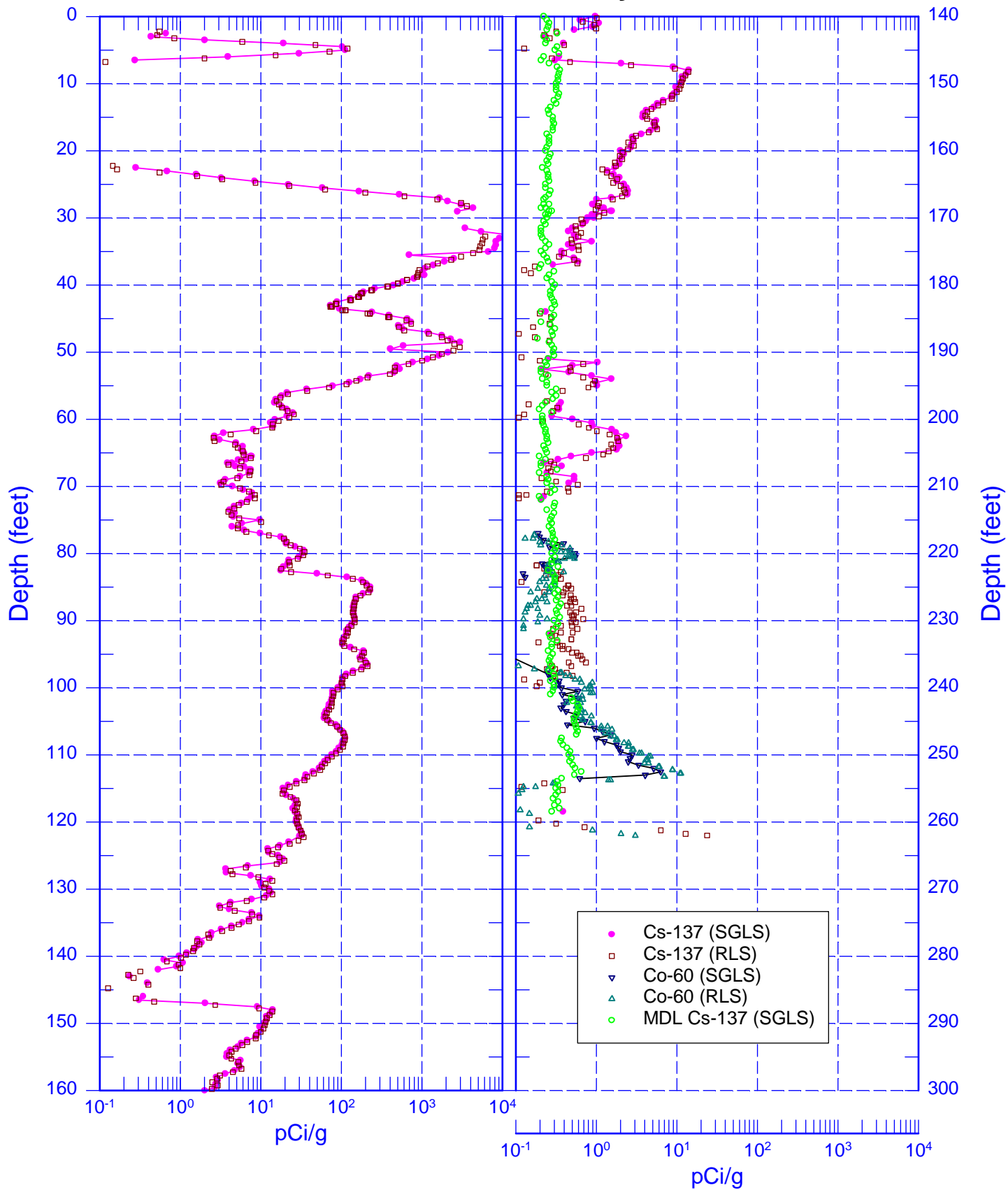
Total Gamma & Dead Time



299-E33-16 (A6855)

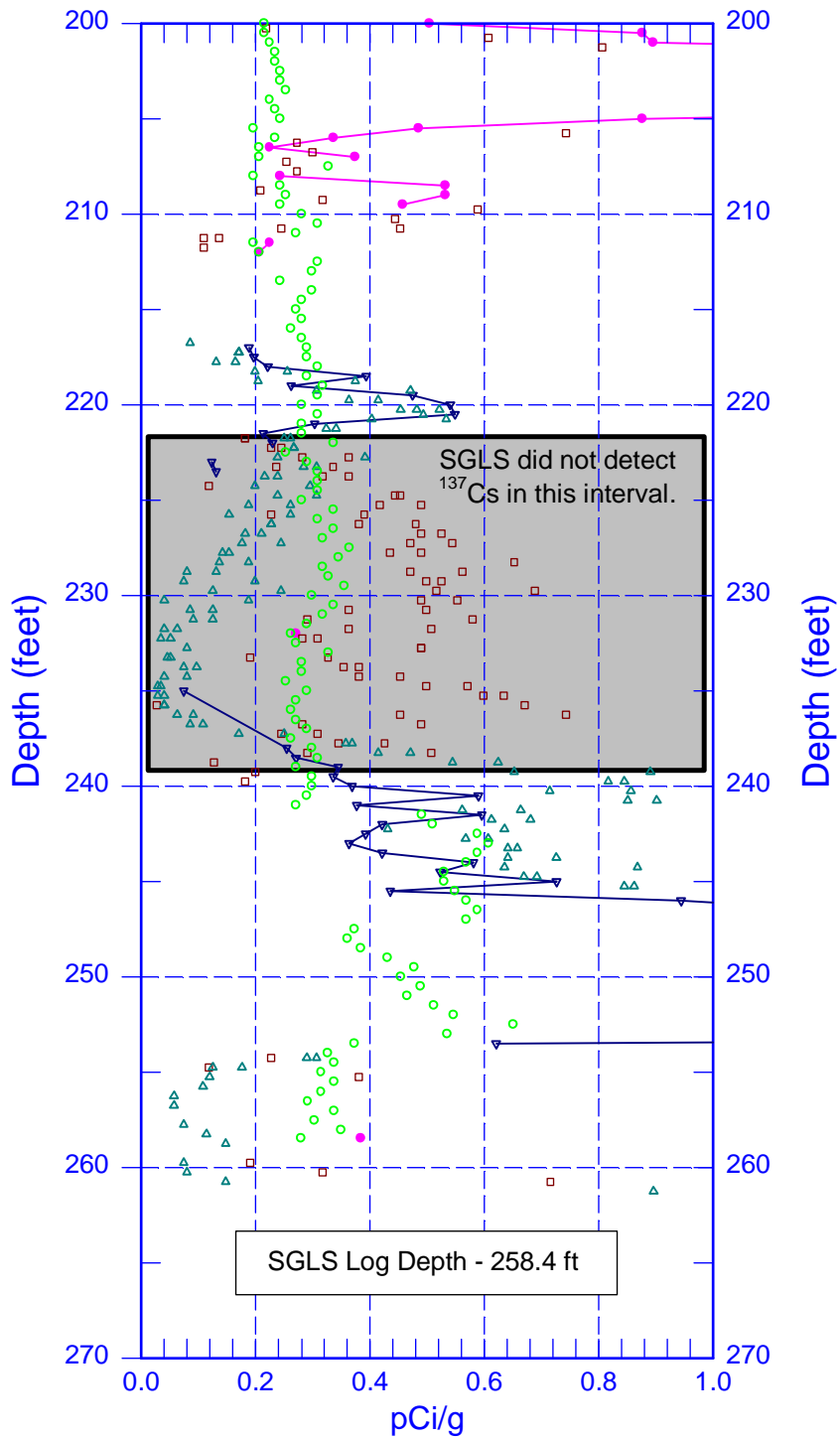
RLS Data Compared to SGLS Data

Man-Made Radionuclides Decayed to 01/10/2002



299-E33-16 (A6855)

RLS Data Compared to SGLS Data (200 to 261 ft)
Man-Made Radionuclides Decayed to 01/10/2002



- Cs-137 (SGLS)
- Cs-137 (RLS)
- ▼ Co-60 (SGLS)
- ▲ Co-60 (RLS)
- MDL Cs-137 (SGLS)